

## § 238.213

(b) Each locomotive, including a cab car and an MU locomotive, ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002, shall have at its forward end, in lieu of the structural protection described in paragraph (a) of this section, either:

(1) Two forward collision posts, located at approximately the one-third points laterally, each capable of withstanding:

(i) A 500,000-pound longitudinal force at the point even with the top of the underframe, without exceeding the ultimate strength of the joint; and

(ii) A 200,000-pound longitudinal force exerted 30 inches above the joint of the post to the underframe, without exceeding the ultimate strength; or

(2) An equivalent end structure that can withstand the sum of the forces that each collision post in paragraph (b)(1)(i) of this section is required to withstand.

(c) The end structure requirements in paragraphs (a) and (b) of this section apply only to the ends of a semi-permanently coupled consist of articulated units, provided that:

(1) The railroad submits to the FRA Associate Administrator for Safety under the procedures specified in § 238.21 a documented engineering analysis establishing that the articulated connection is capable of preventing disengagement and telescoping to the same extent as equipment satisfying the anti-climbing and collision post requirements contained in this subpart; and

(2) FRA finds the analysis persuasive.

## § 238.213 Corner posts.

(a) Each passenger car shall have at each end of the car, placed ahead of the occupied volume, two full-height corner posts capable of resisting:

(1) A horizontal load of 150,000 pounds at the point of attachment to the underframe without failure;

(2) A horizontal load of 20,000 pounds at the point of attachment to the roof structure without failure; and

(3) A horizontal load of 30,000 pounds applied 18 inches above the top of the floor without permanent deformation.

(b) For purposes of this section, the orientation of the applied horizontal

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loads shall range from longitudinal inward to transverse inward.

## § 238.215 Rollover strength.

(a) Each passenger car shall be designed to rest on its side and be uniformly supported at the top (“roof rail”), the bottom cords (“side sill”) of the side frame, and, if bi-level, the intermediate floor rail. The allowable stress in the structural members of the occupied volumes for this condition shall be one-half yield or one-half the critical buckling stress, whichever is less. Local yielding to the outer skin of the passenger car is allowed provided that the resulting deformations in no way intrude upon the occupied volume of the car.

(b) Each passenger car shall also be designed to rest on its roof so that any damage in occupied areas is limited to roof sheathing and framing. Other than roof sheathing and framing, the allowable stress in the structural members of the occupied volumes for this condition shall be one-half yield or one-half the critical buckling stress, whichever is less. Deformation to the roof sheathing and framing is allowed to the extent necessary to permit the vehicle to be supported directly on the top chords of the side frames and end frames.

## § 238.217 Side structure.

Each passenger car shall comply with the following:

(a) *Side posts and corner braces.*

(1) For modified girder, semi-monocoque, or truss construction, the sum of the section moduli in inches<sup>3</sup>—about a longitudinal axis, taken at the weakest horizontal section between the side sill and side plate—of all posts and braces on each side of the car located between the body corner posts shall be not less than 0.30 multiplied by the distance in feet between the centers of end panels.

(2) For modified girder or semi-monocoque construction only, the sum of the section moduli in inches<sup>3</sup>—about a transverse axis, taken at the weakest horizontal section between the side sill and side plate—of all posts, braces and pier panels, to the extent available, on each side of the car located between body corner posts shall be not less than

0.20 multiplied by the distance in feet between the centers of end panels.

(3) The center of an end panel is the point midway between the center of the body corner post and the center of the adjacent side post.

(4) The minimum section moduli or thicknesses specified in paragraph (a) of this section may be adjusted in proportion to the ratio of the yield strength of the material used to that of mild open-hearth steel for a car whose structural members are made of a higher strength steel.

(b) *Sheathing.*

(1) Outside sheathing of mild, open-hearth steel when used flat, without reinforcement (other than side posts) in a side frame of modified girder or semi-monocoque construction shall not be less than 1/8 inch nominal thickness. Other metals may be used of a thickness in inverse proportion to their yield strengths.

(2) Outside metal sheathing of less than 1/8 inch thickness may be used only if it is reinforced so as to produce at least an equivalent sectional area at a right angle to reinforcements as that of the flat sheathing specified in paragraph (b)(1) of this section.

(3) When the sheathing used for truss construction serves no load-carrying function, the minimum thickness of that sheathing shall be not less than 40 percent of that specified in paragraph (b)(1) of this section.

**§ 238.219 Truck-to-car-body attachment.**

Passenger equipment shall have a truck-to-car-body attachment with an ultimate strength sufficient to resist without failure a force of 2g vertical on the mass of the truck and a force of 250,000 pounds in any horizontal direction on the truck. For purposes of this section, the mass of the truck includes axles, wheels, bearings, the truck-mounted brake system, suspension system components, and any other components attached to the truck by design.

**§ 238.221 Glazing.**

(a) Passenger equipment shall comply with the applicable Safety Glazing Standards contained in part 223 of this chapter, if required by that part.

(b) Each exterior window on a locomotive cab and a passenger car shall remain in place when subjected to:

(1) The forces described in part 223 of this chapter; and

(2) The forces due to air pressure differences caused when two trains pass at the minimum separation for two adjacent tracks, while traveling in opposite directions, each train traveling at the maximum authorized speed.

**§ 238.223 Locomotive fuel tanks.**

(a) *External fuel tanks.* External locomotive fuel tanks shall comply with the requirements contained in Appendix D to this part, or an industry standard providing at least an equivalent level of safety if approved by FRA under § 238.21.

(b) *Internal fuel tanks.*

(1) Internal locomotive fuel tanks shall be positioned in a manner to reduce the likelihood of accidental penetration from roadway debris or collision.

(2) Internal fuel tank vent systems shall be designed so they do not become a path of fuel loss in any tank orientation due to a locomotive overturning.

(3) Internal fuel tank bulkheads and skin shall at a minimum be equivalent to a 3/8-inch thick steel plate with a 25,000 pounds-per-square-inch yield strength. Material of a higher yield strength may be used to decrease the required thickness of the material provided at least an equivalent level of strength is maintained. Skid plates are not required.

**§ 238.225 Electrical system.**

All passenger equipment shall comply with the following:

(a) *Conductors.* Conductor sizes shall be selected on the basis of current-carrying capacity, mechanical strength, temperature, flexibility requirements, and maximum allowable voltage drop. Current-carrying capacity shall be derated for grouping and for operating temperature.

(b) *Main battery system.*

(1) The main battery compartment shall be isolated from the cab and passenger seating areas by a non-combustible barrier.